

**LOW POWER DUAL OPERATIONAL AMPLIFIERS****AS358/358A****General Description**

The AS358/358A consist of two independent, high gain and internally frequency compensated operational amplifiers, they are specifically designed to operate from a single power supply. Operation from split power supply is also possible and the low power supply current drain is independent of the magnitude of the power supply voltages. Typical applications include transducer amplifiers, DC gain blocks and most conventional operational amplifier circuits.

The AS358/358A series are compatible with industry standard 358. AS358A has more stringent input offset voltage than AS358.

The AS358 is available in DIP-8, SOIC-8, TSSOP-8 and MSOP-8 packages, AS358A is available in DIP-8 and SOIC-8 packages.

Features

- Internally Frequency Compensated for Unity Gain
- Large Voltage Gain: 100dB (Typical)
- Low Input Bias Current: 20nA (Typical)
- Low Input Offset Voltage: 2mV (Typical)
- Low Supply Current: 0.5mA (Typical)
- Wide Power Supply Voltage:
 - Single Supply: 3V to 36V
 - Dual Supplies: $\pm 1.5V$ to $\pm 18V$
- Input Common Mode Voltage Range Includes Ground
- Large Output Voltage Swing: 0V to $V_{CC} - 1.5V$

Applications

- Battery Charger
- Cordless Telephone
- Switching Power Supply

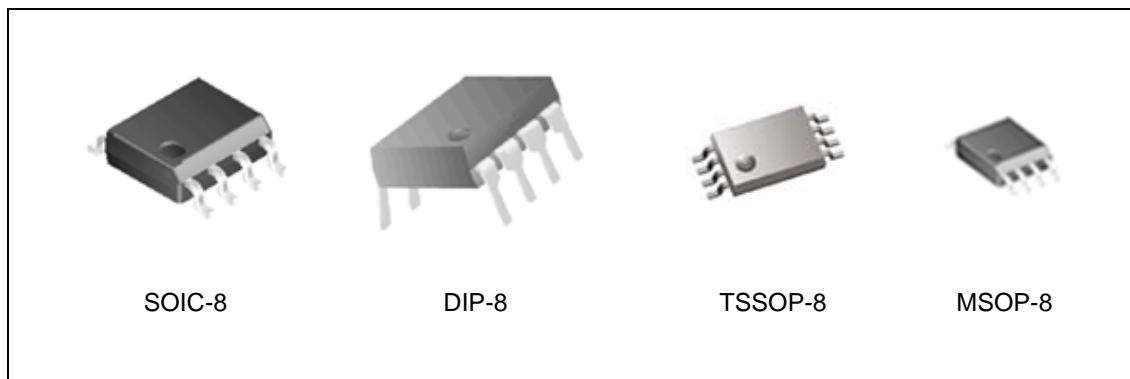


Figure 1. Package Types of AS358/358A



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AS358/358A

Pin Configuration

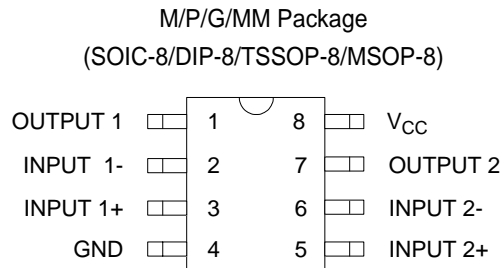


Figure 2. Pin Configuration of AS358/358A (Top View)

Functional Block Diagram

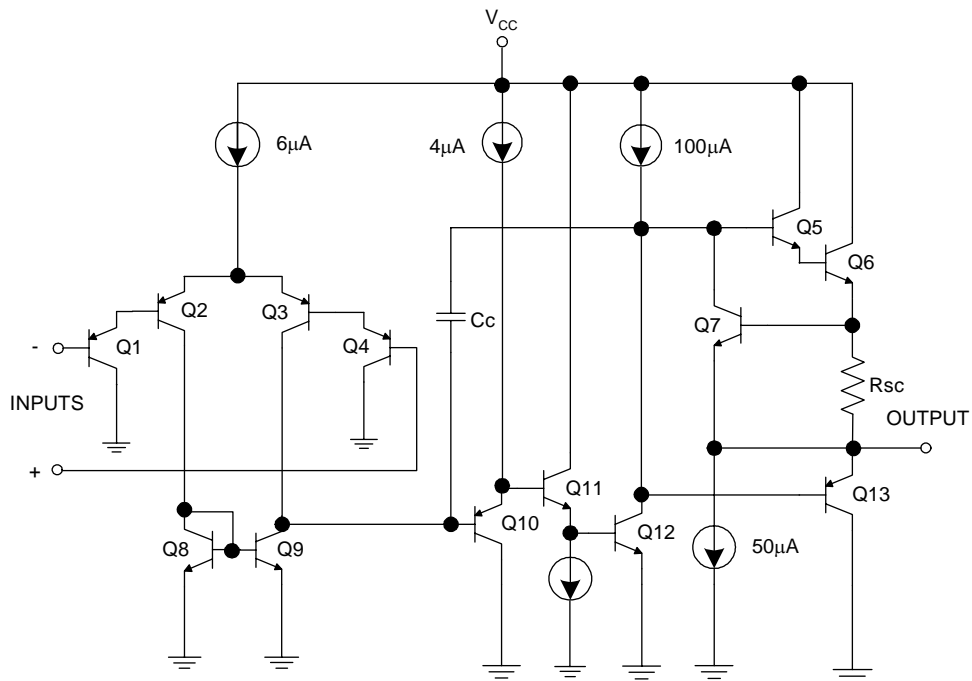


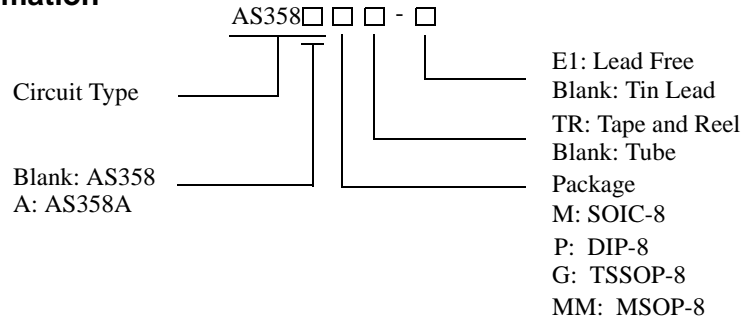
Figure 3. Functional Block Diagram of AS358/358A
(Each Amplifier)



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Ordering Information



Package	Temperature Range	Part Number		Marking ID		Packing Type
		Tin Lead	Lead Free	Tin Lead	Lead Free	
SOIC-8	-40 to 85°C	AS358M	AS358M-E1	AS358M	AS358M-E1	Tube
		AS358MTR	AS358MTR-E1	AS358M	AS358M-E1	Tape & Reel
			AS358AM-E1		AS358AM-E1	Tube
			AS358AMTR-E1		AS358AM-E1	Tape & Reel
DIP-8	-40 to 85°C	AS358P	AS358P-E1	AS358P	AS358P-E1	Tube
			AS358AP-E1		AS358AP-E1	Tube
TSSOP-8	-40 to 85°C		AS358G-E1		EG3A	Tube
			AS358GTR-E1		EG3A	Tape & Reel
MSOP-8	-40 to 85°C		AS358MM-E1		AS358MM-E1	Tube
			AS358MMTR-E1		AS358MM-E1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.

**LOW POWER DUAL OPERATIONAL AMPLIFIERS****AS358/358A****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit	
Power Supply Voltage	V_{CC}	40	V	
Differential Input Voltage	V_{ID}	40	V	
Input Voltage	V_{IC}	-0.3 to 40	V	
Power Dissipation ($T_A=25^{\circ}\text{C}$)	P_D	DIP-8	830	mW
		SOIC-8	550	
		TSSOP-8	500	
		MSOP-8	470	
Operating Junction Temperature	T_J	150	$^{\circ}\text{C}$	
Storage Temperature Range	T_{STG}	-65 to 150	$^{\circ}\text{C}$	
Lead Temperature (Soldering, 10 Seconds)	T_{LEAD}	260	$^{\circ}\text{C}$	

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	3	36	V
Ambient Operating Temperature Range	T_A	-40	85	$^{\circ}\text{C}$



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Electrical Characteristics

Limits in standard typeface are for $T_A=25^\circ\text{C}$, **bold** typeface applies over -40°C to 85°C (Note 2), $V_{CC}=5\text{V}$, $\text{GND}=0\text{V}$, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Input Offset Voltage	V_{IO}	$V_O=1.4\text{V}$, $R_S=0\Omega$, $V_{CC}=5\text{V}$ to 30V	AS358		2	5	mV
						7	
			AS358A		2	3	
						5	
Average Temperature Coefficient of Input Offset Voltage	$\Delta V_{IO}/\Delta T$	$T_A=-40$ to 85°C		7		$\mu\text{V}/^\circ\text{C}$	
Input Bias Current	I_{BIAS}	I_{IN+} or I_{IN-} , $V_{CM}=0\text{V}$		20	200	nA	
					200		
Input Offset Current	I_{IO}	$I_{IN+} - I_{IN-}$, $V_{CM}=0\text{V}$		5	30	nA	
					100		
Input Common Mode Voltage Range (Note 3)	V_{IR}	$V_{CC}=30\text{V}$	0		$V_{CC}-1.5$	V	
Supply Current	I_{CC}	$T_A=-40$ to 85°C , $R_L=\infty$, $V_{CC}=30\text{V}$		0.7	2	mA	
		$T_A=-40$ to 85°C , $R_L=\infty$, $V_{CC}=5\text{V}$		0.5	1.2		
Large Signal Voltage Gain	G_V	$V_{CC}=15\text{V}$, $V_O=1\text{V}$ to 11V , $R_L \geq 2\text{k}\Omega$	85	100		dB	
			80				
Common Mode Rejection Ratio	CMRR	DC, $V_{CM}=0\text{V}$ to $(V_{CC}-1.5)\text{V}$	60	70		dB	
			60				
Power Supply Rejection Ratio	PSRR	$V_{CC}=5\text{V}$ to 30V	70	100		dB	
			60				
Channel Separation	CS	$f=1\text{kHz}$ to 20kHz		-120		dB	
Output Current	Source	I_{SOURCE}	$V_{IN+}=1\text{V}$, $V_{IN-}=0\text{V}$, $V_{CC}=15\text{V}$, $V_O=2\text{V}$	20	40	mA	
				20			
	Sink	I_{SINK}	$V_{IN+}=0\text{V}$, $V_{IN-}=1\text{V}$, $V_{CC}=15\text{V}$, $V_O=2\text{V}$	10	15	mA	
				5			
			$V_{IN+}=0\text{V}$, $V_{IN-}=1\text{V}$, $V_{CC}=15\text{V}$, $V_O=0.2\text{V}$	12	50	μA	
Output Short Circuit Current to Ground	I_{SC}	$V_{CC}=15\text{V}$		40	60	mA	
Output Voltage Swing	V_{OH}	$V_{CC}=30\text{V}$, $R_L=2\text{k}\Omega$	26			V	
			26				
		$V_{CC}=30\text{V}$, $R_L=10\text{k}\Omega$	27	28			
			27				
	V_{OL}	$V_{CC}=5\text{V}$, $R_L=10\text{k}\Omega$		5	20	mV	
					30		

Note 2: Limits over the full temperature are guaranteed by design, but not tested in production.

**LOW POWER DUAL OPERATIONAL AMPLIFIERS****AS358/358A****Electrical Characteristics (Continued)**

Note 3: The input common-mode voltage of either input signal voltage should not be allowed to go negatively by more than 0.3V (at 25°C). The upper end of the common-mode voltage range is $V_{CC}-1.5V$ (at 25°C), but either or both inputs can go to +36V without damages, independent of the magnitude of the V_{CC} .

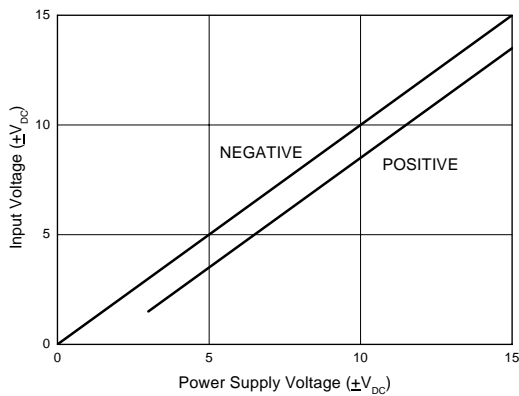
Typical Performance Characteristics

Figure 4. Input Voltage Range

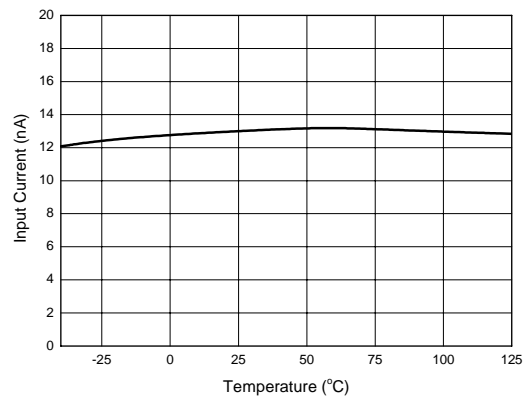


Figure 5. Input Current

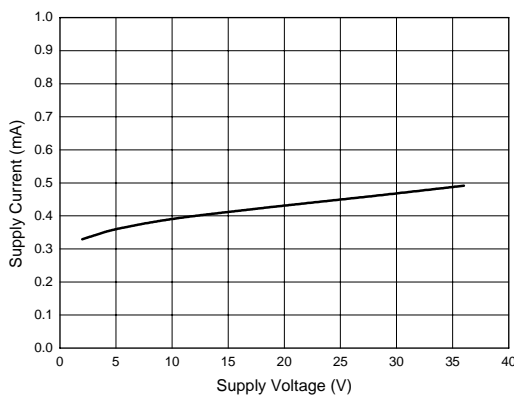


Figure 6. Supply Current

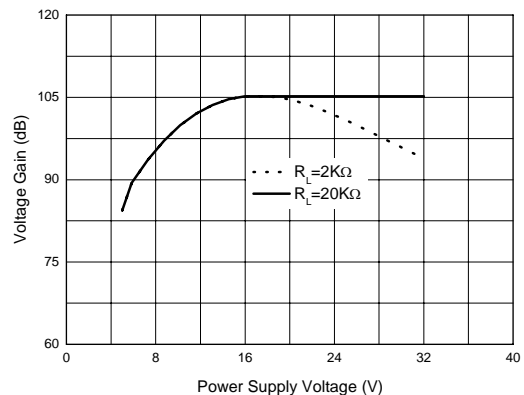


Figure 7. Voltage Gain



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Typical Performance Characteristics (Continued)

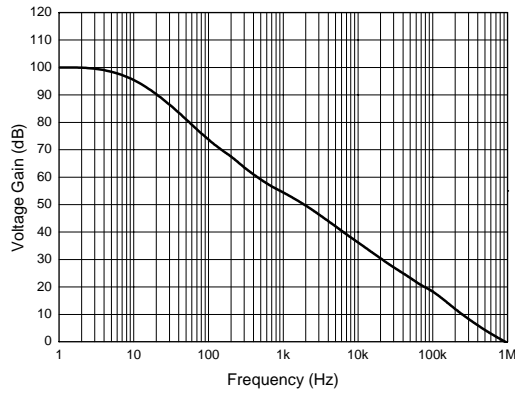


Figure 8. Open Loop Frequency Response

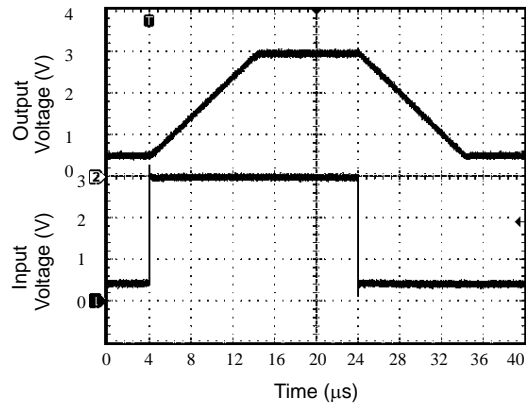


Figure 9. Voltage Follower Pulse Response

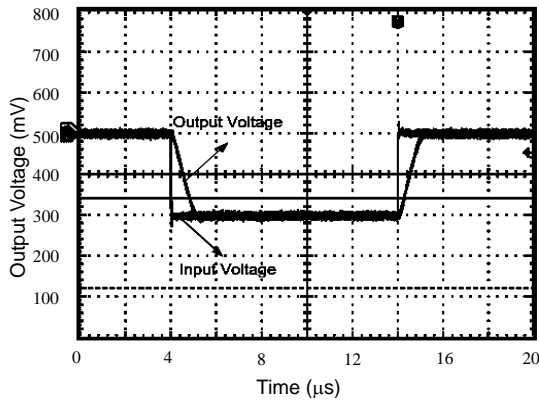


Figure 10. Voltage Follower Pulse Response
(Small Signal)

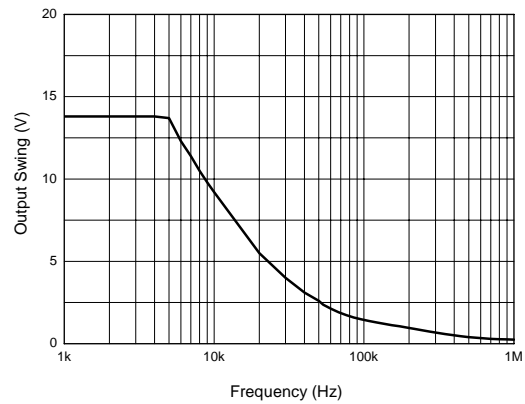


Figure 11. Large Signal Frequency Response



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Typical Performance Characteristics (Continued)

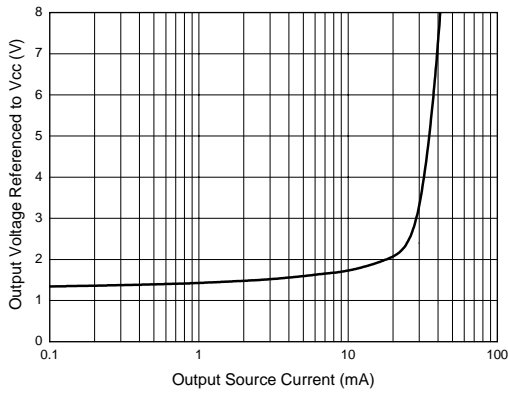


Figure 12. Output Characteristics: Current Sourcing

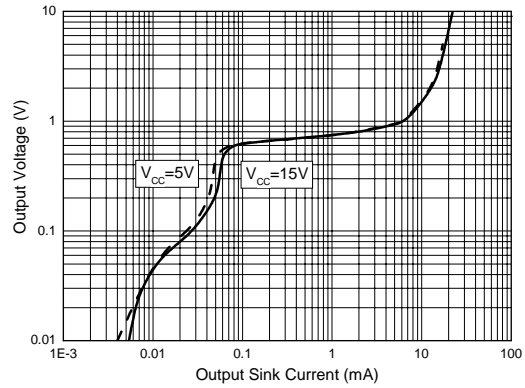


Figure 13. Output Characteristics: Current Sinking

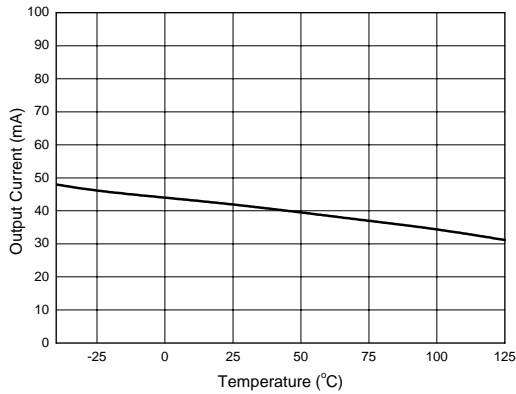


Figure 14. Current Limiting



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Typical Application

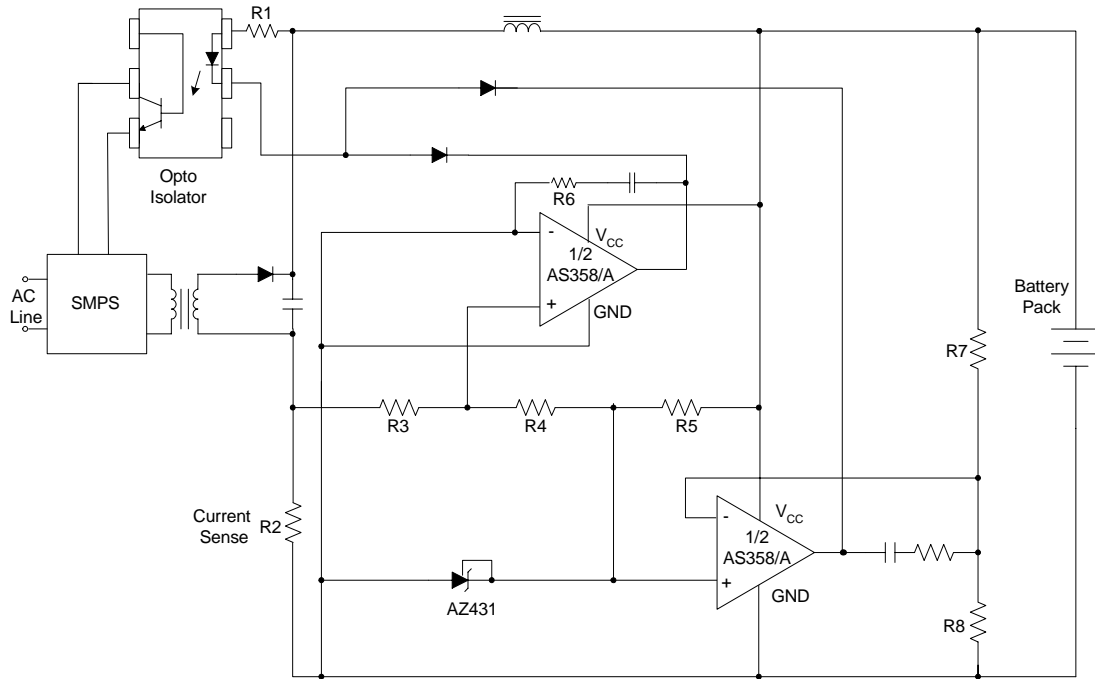


Figure 15. Battery Charger

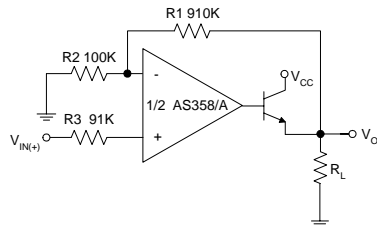


Figure 16. Power Amplifier

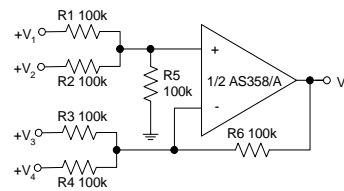


Figure 17. DC Summing Amplifier



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Typical Application (Continued)

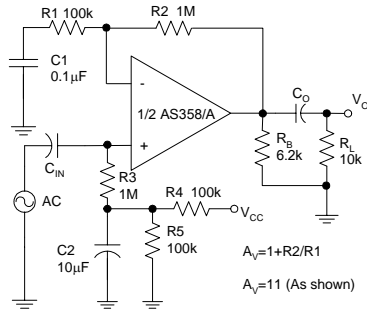


Figure 18. AC Coupled Non-Inverting Amplifier

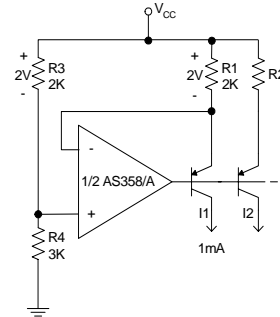


Figure 19. Fixed Current Sources

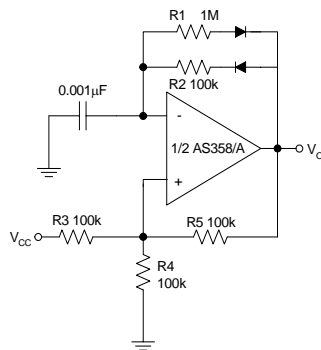


Figure 20. Pulse Generator

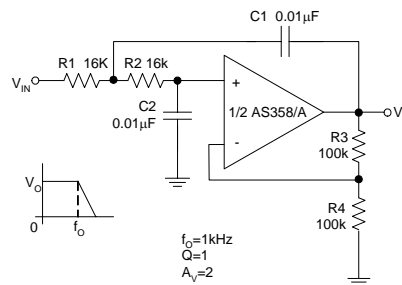


Figure 21. DC Coupled Low-Pass Active Filter



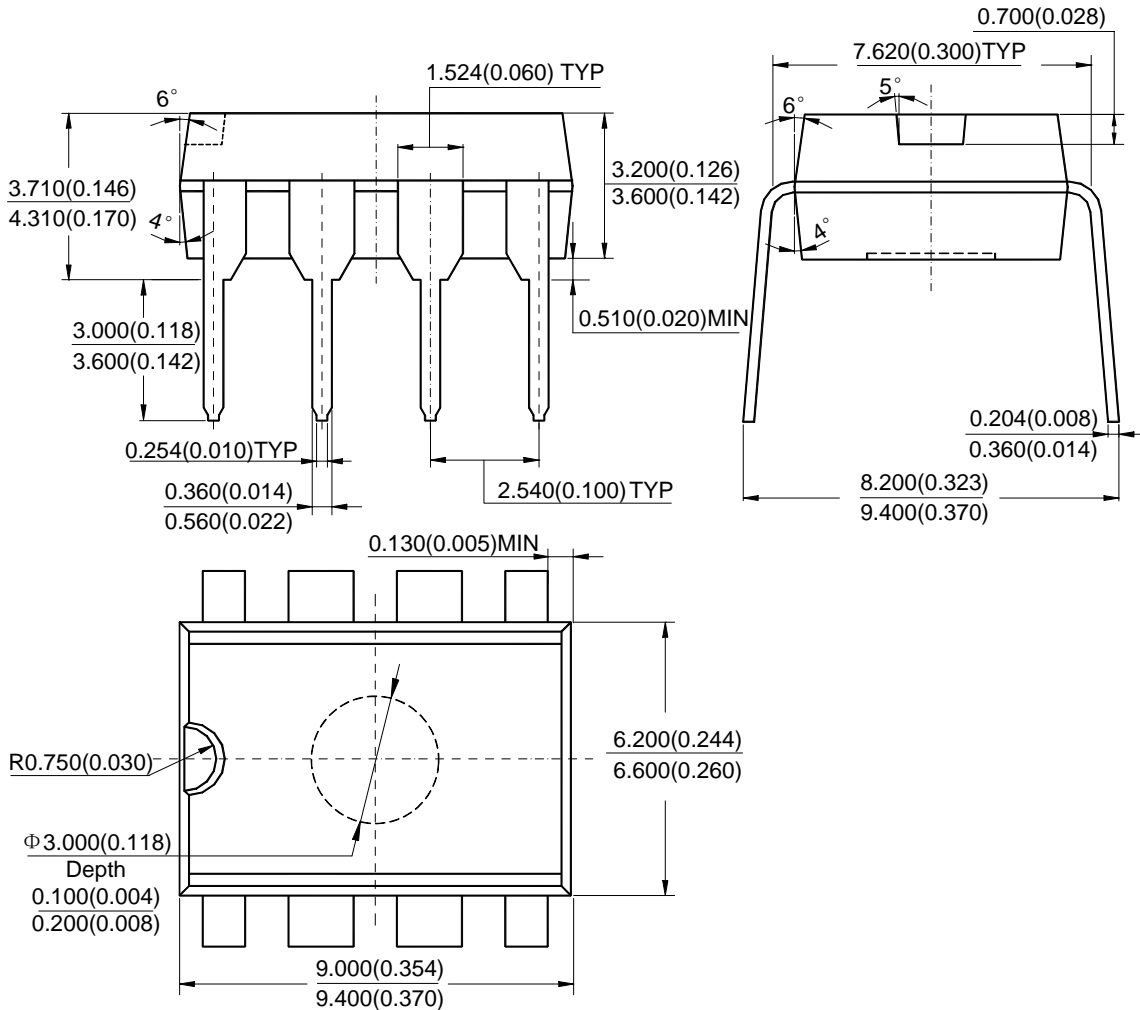
LOW POWER DUAL OPERATIONAL AMPLIFIERS

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Mechanical Dimensions

DIP-8

Unit: mm(inch)





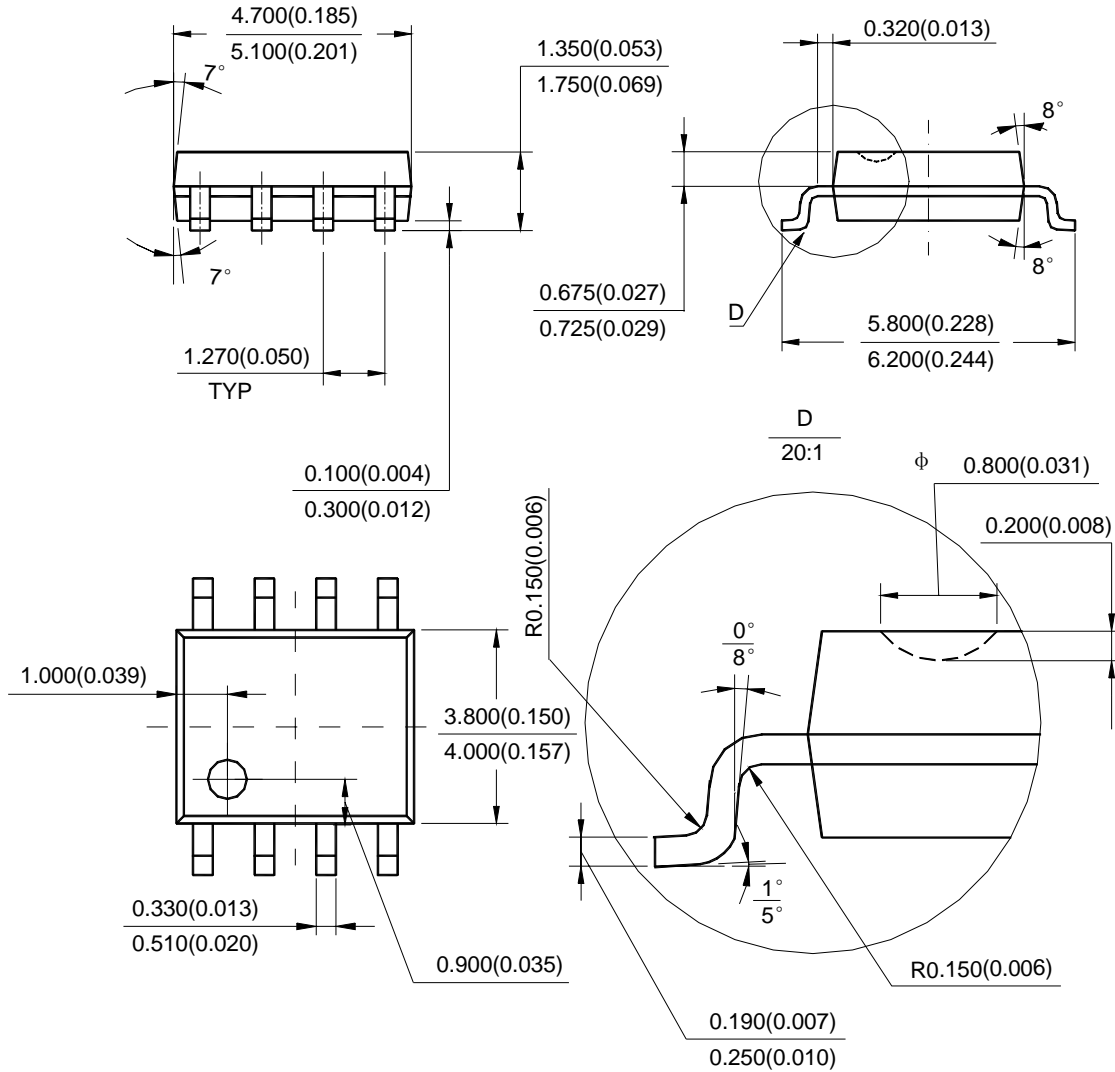
LOW POWER DUAL OPERATIONAL AMPLIFIERS

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Mechanical Dimensions (Continued)

SOIC-8

Unit: mm(inch)





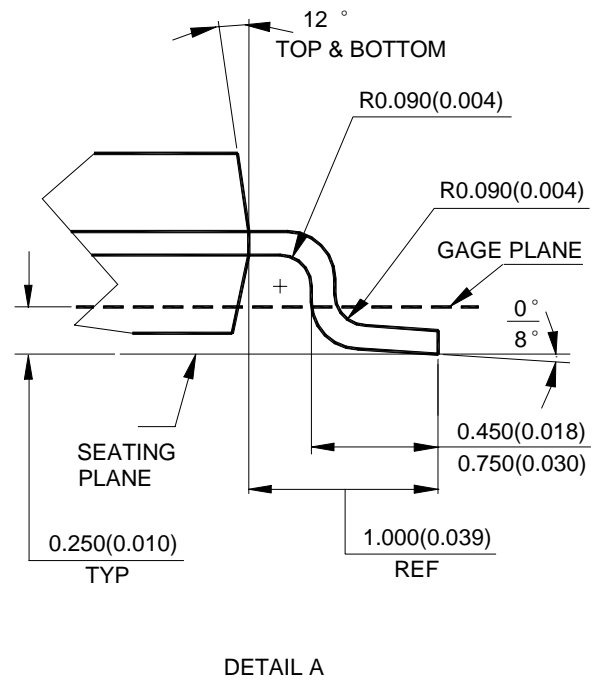
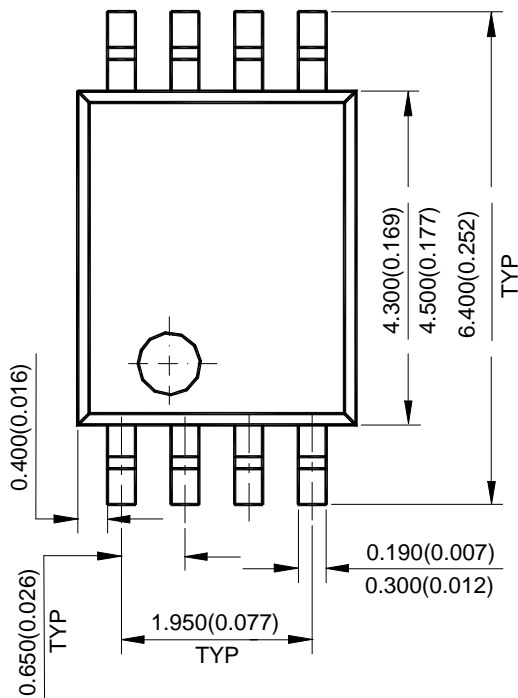
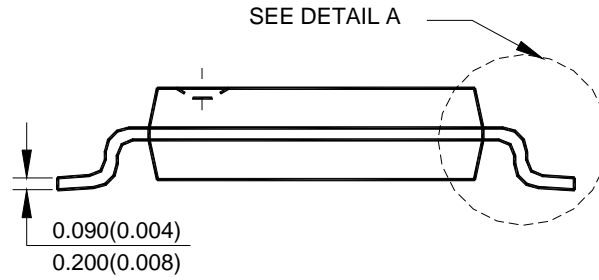
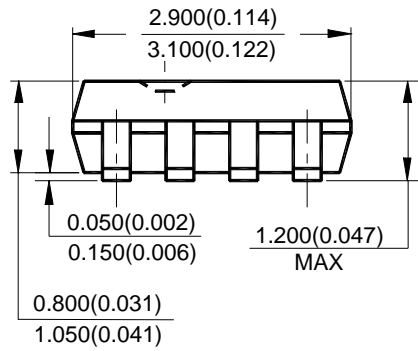
LOW POWER DUAL OPERATIONAL AMPLIFIERS

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Mechanical Dimensions (Continued)

TSSOP-8

Unit: mm(inch)





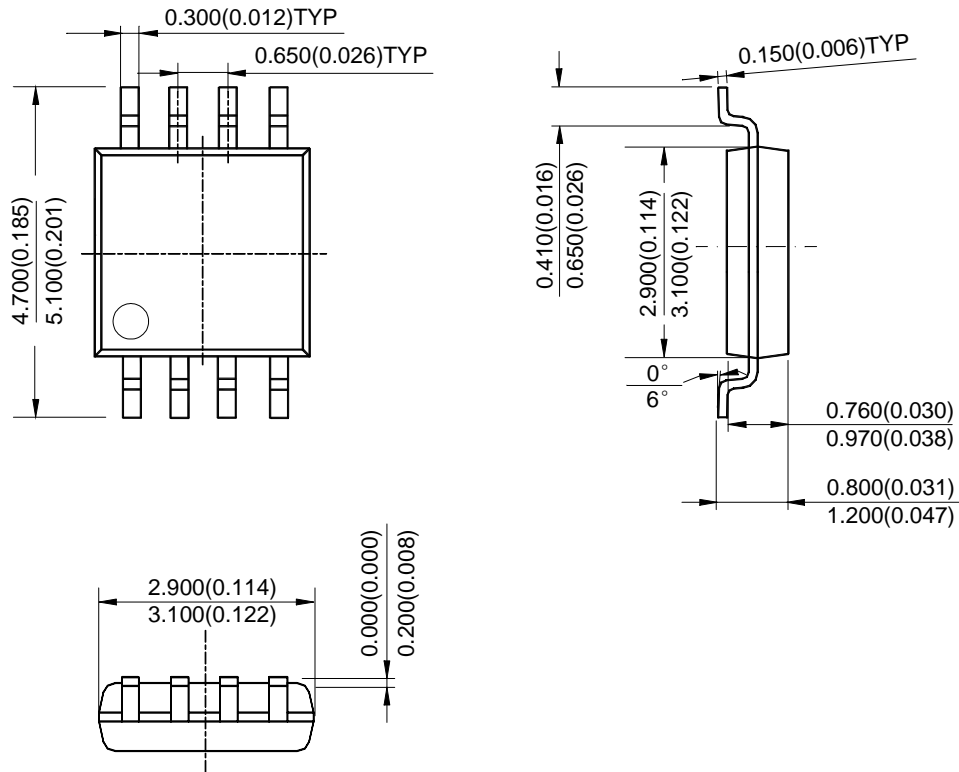
LOW POWER DUAL OPERATIONAL AMPLIFIERS

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Mechanical Dimensions

MSOP-8

Unit: mm(inch)





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MAIN SITE

BCD Semiconductor Manufacturing Limited

- Wafer Fab

Shanghai SIM-BCD Semiconductor Manufacturing Limited

800, Yi Shan Road, Shanghai 200233, China
Tel: +86-21-6485 1491, Fax: +86-21-5450 0008

BCD Semiconductor Manufacturing Limited

- IC Design Group

Advanced Analog Circuits (Shanghai) Corporation
8F, Zone B, 900, Yi Shan Road, Shanghai 200233, China
Tel: +86-21-6495 9539, Fax: +86-21-6485 9673

REGIONAL SALES OFFICE

Shenzhen Office

Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd. Shenzhen Office

Advanced Analog Circuits (Shanghai) Corporation Shenzhen Office
Room E, 5F, Noble Center, No.1006, 3rd Fuzhong Road, Futian District, Shenzhen 518026, China
Tel: +86-755-8826 7951, Fax: +86-755-8826 7865

Taiwan Office

BCD Semiconductor (Taiwan) Company Limited

4F, 298-1, Rui Guang Road, Nei-Hu District, Taipei,
Taiwan
Tel: +886-2-2656 2808, Fax: +886-2-2656 2806

USA Office

BCD Semiconductor Corporation

3170 De La Cruz Blvd., Suite 105,
Santa Clara,
CA 95054-2411, U.S.A